



Large-Scale In-Situ MTBE Biobarrier Demonstration at Port Hueneme, CA

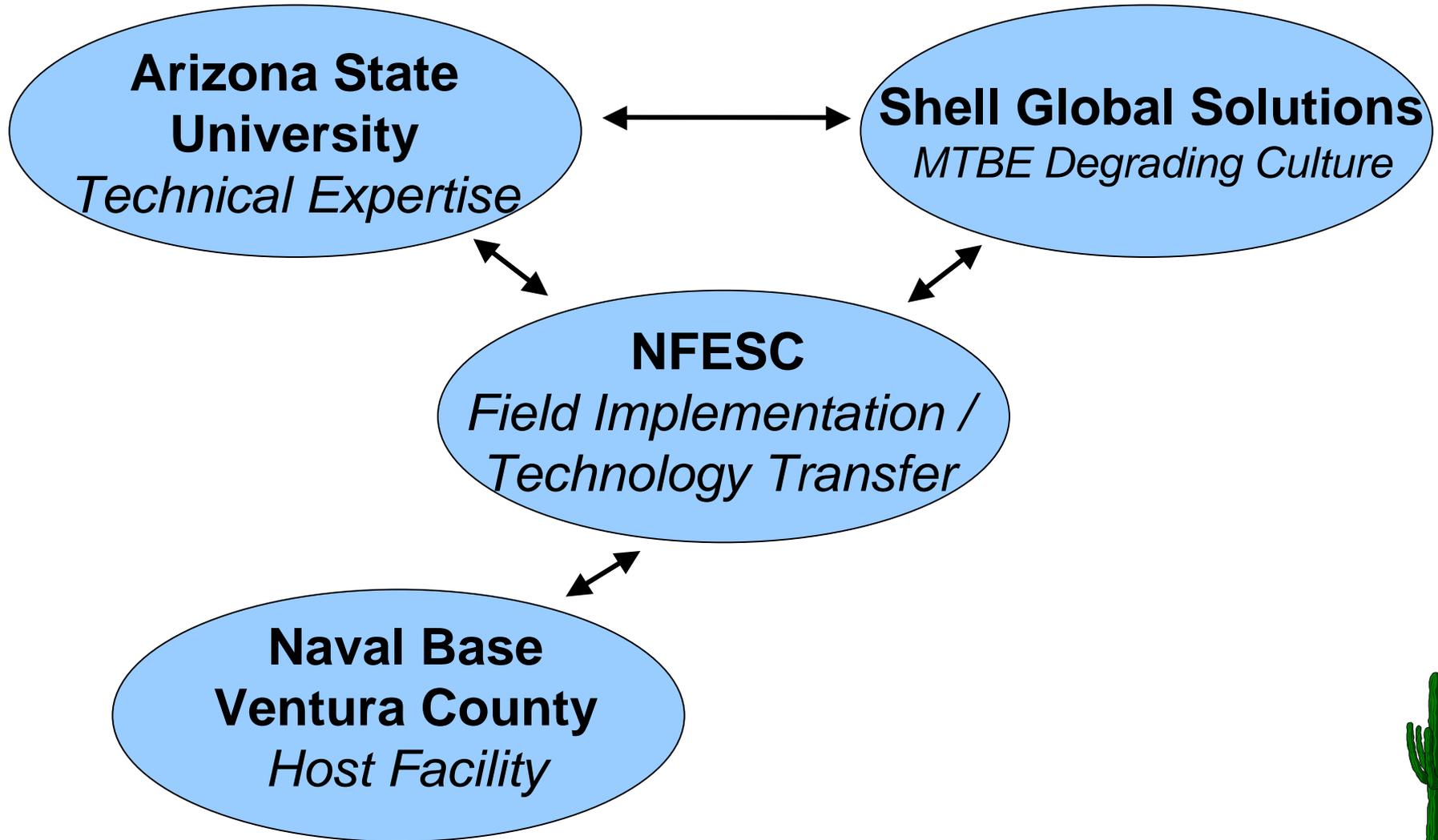
*SAM Fall 2003 Forum
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ESTCP Biobarrier Team

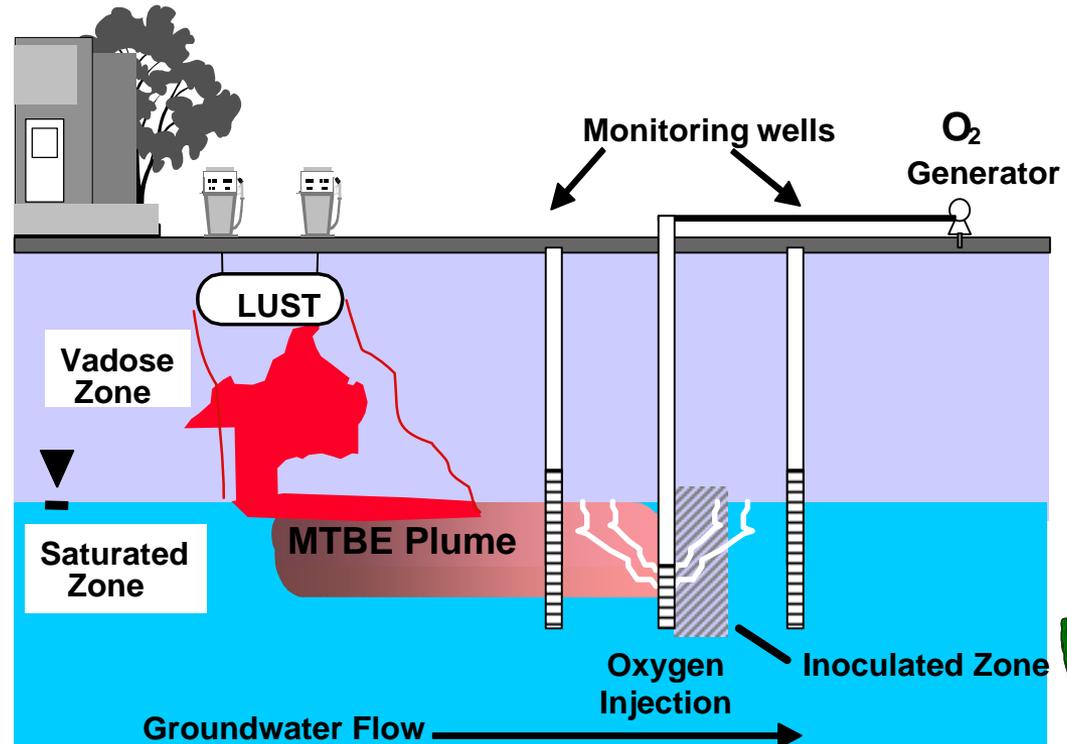


Biobarrier Technology Overview

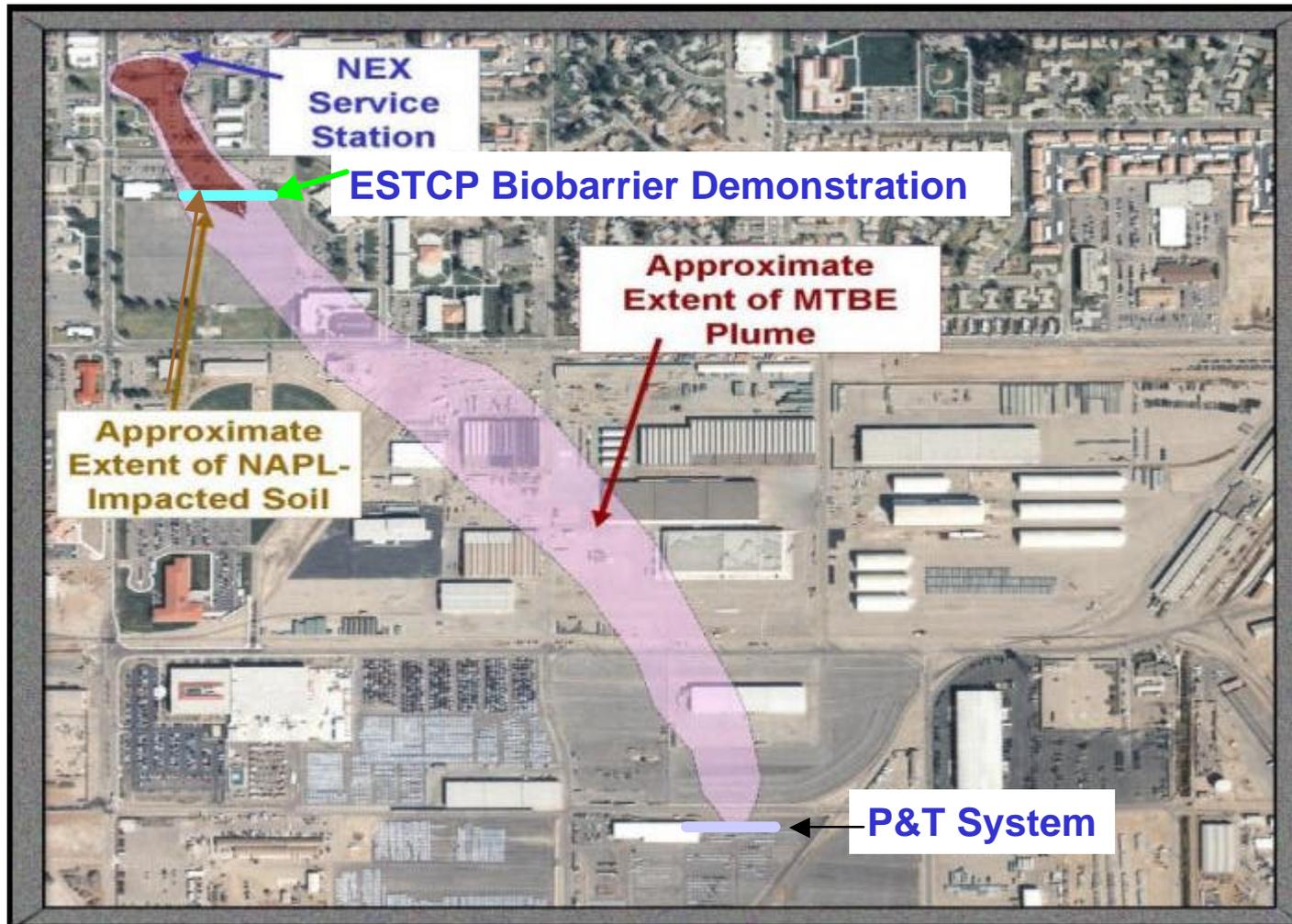


- Treatment of MTBE-contaminated aquifers through:
- inoculation with MTBE-degrading organisms (MC-100 and SC-100)
 - aeration/oxygenation of the aquifer

Apply biobarrier technology to a mixed MTBE-BTEX dissolved plume



NBVC, Port Hueneme, CA



Demonstration System Design



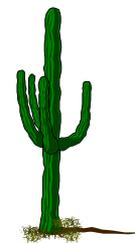
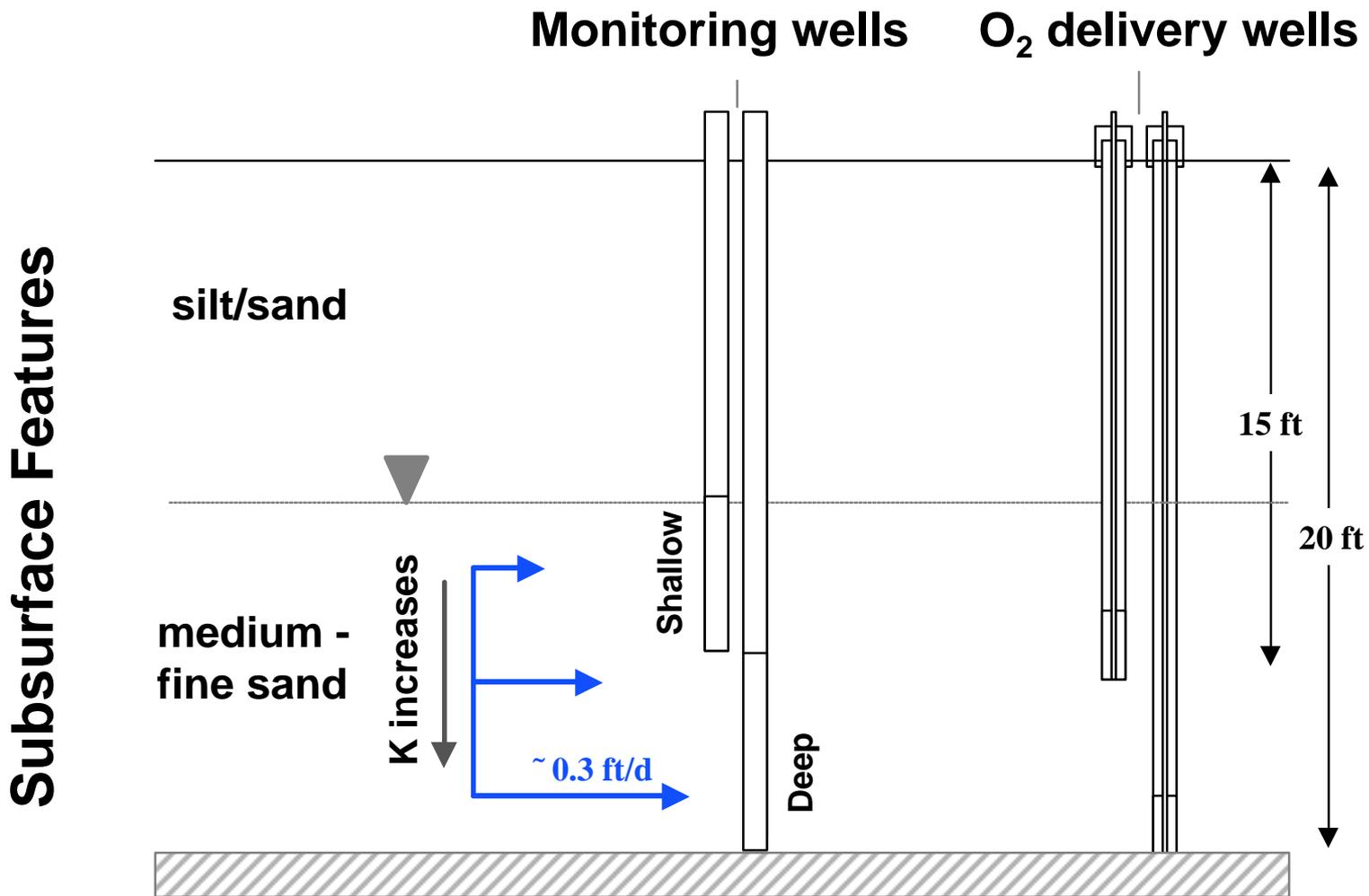
- (1) Treatment system must not alter the natural flow path**
- (2) Modular and flexible with respect to operating conditions.**

- (1) Close well spacing**
- (2) Injection at two depths**
- (3) Pulsed gas injection (air and O₂)**

[trapped gas supplies oxygen for days after injection]



Biobarrier Subsurface Features



Biobarrier Installation, Aug 2000



**500 ft wide
contaminant barrier**

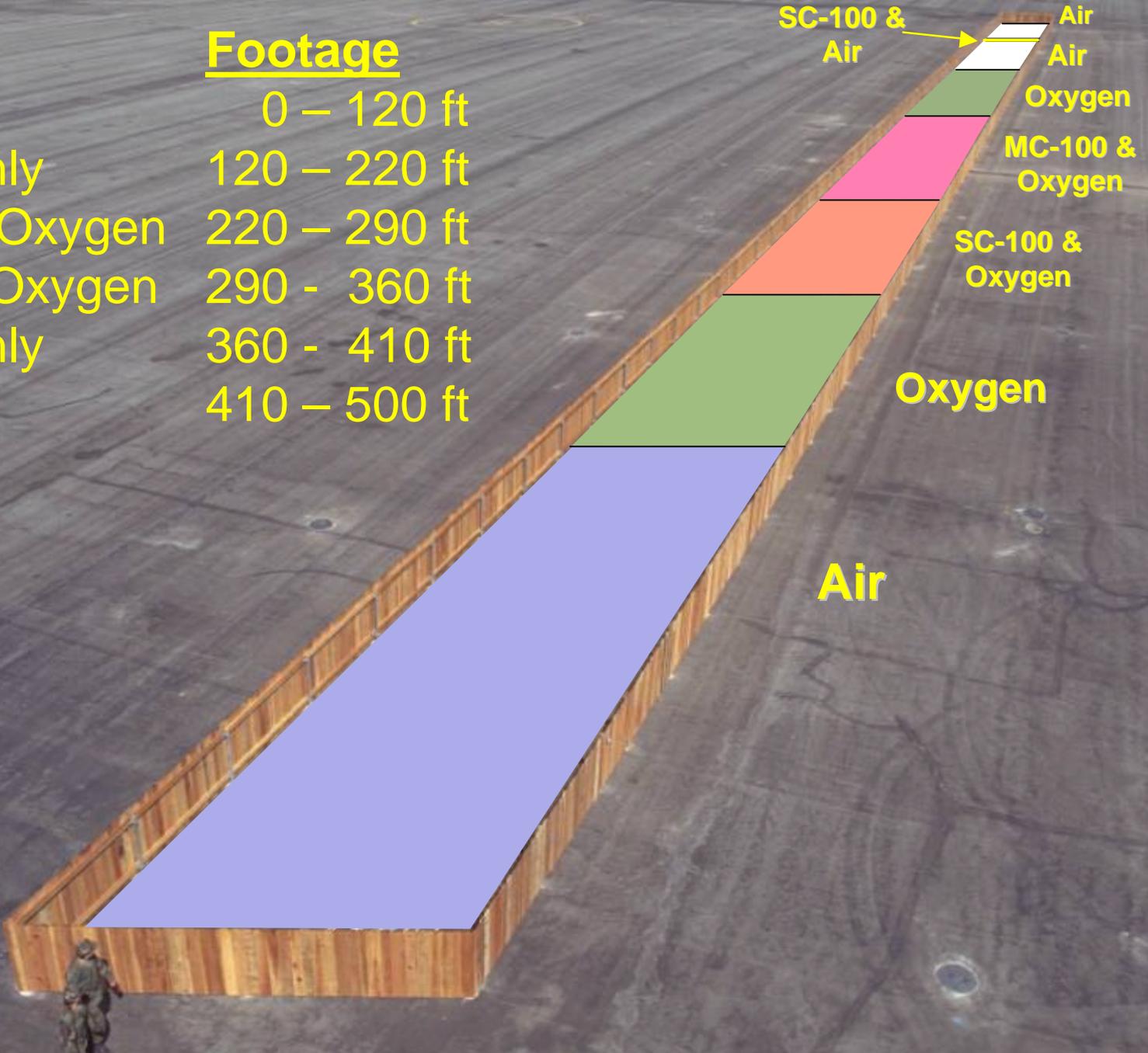
- 252 air / O₂ injection wells
- 174 monitoring wells



Section

Footage

Air Only	0 – 120 ft
Oxygen Only	120 – 220 ft
MC-100 & Oxygen	220 – 290 ft
SC-100 & Oxygen	290 - 360 ft
Oxygen Only	360 - 410 ft
Air Only	410 – 500 ft



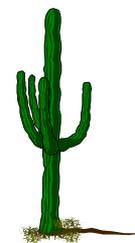
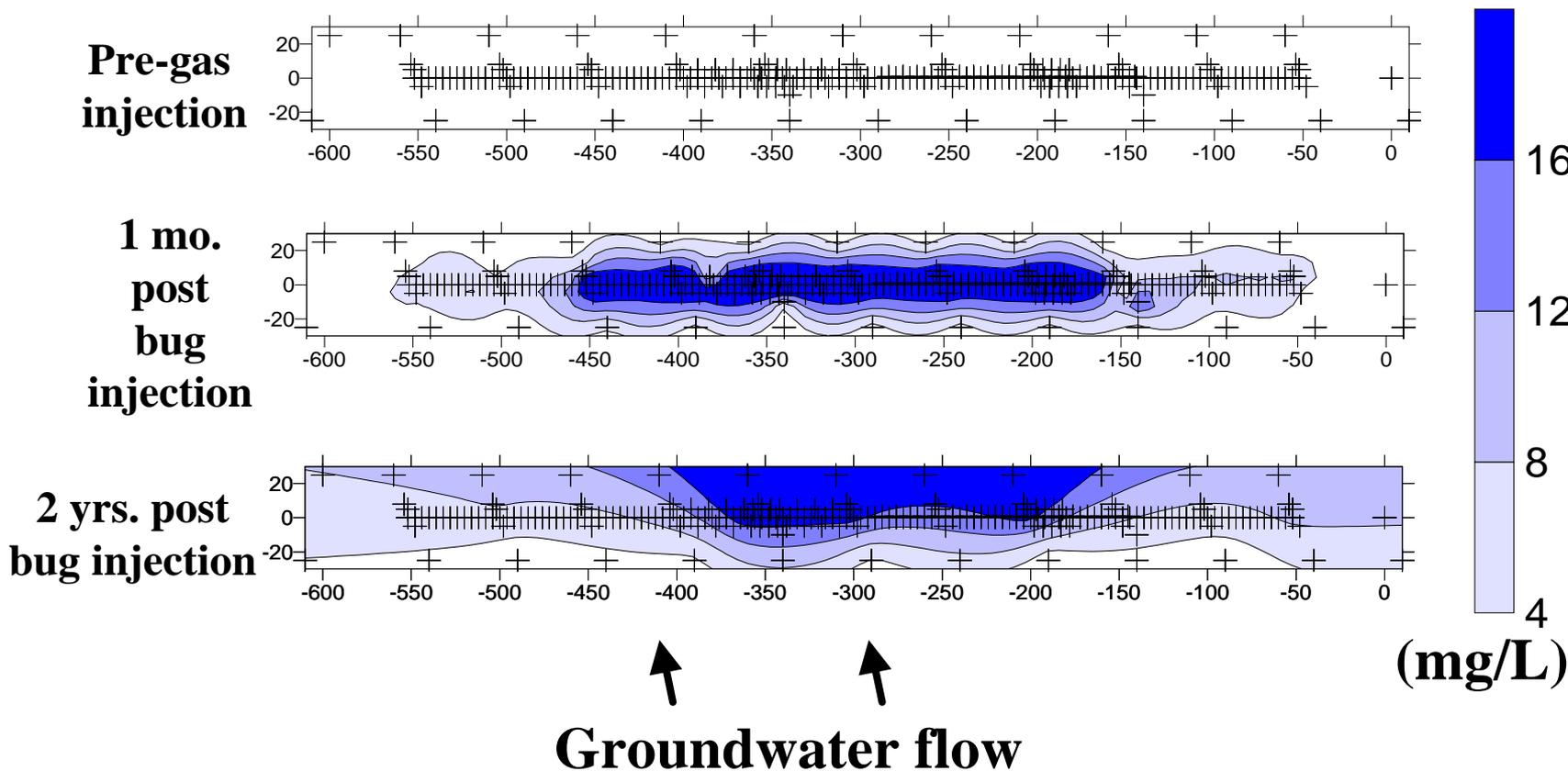
Microbial Inoculation



Seeded 165 feet of the BioBarrier with MTBE degrading cultures from Shell Global Solutions.



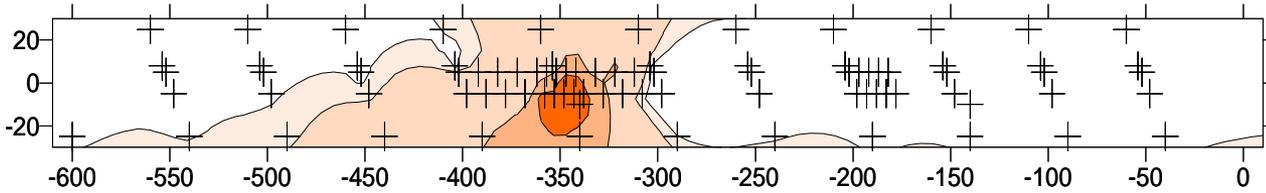
Dissolved Oxygen Distribution



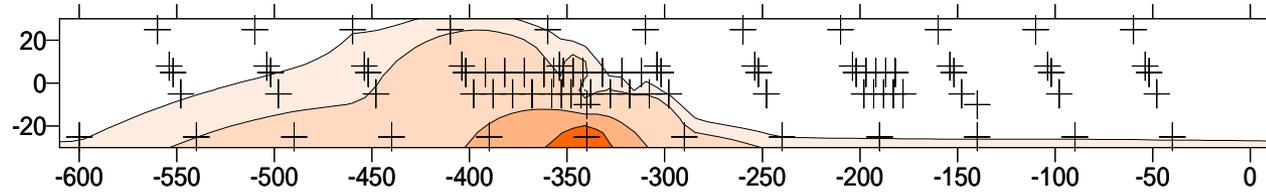
Benzene Distribution



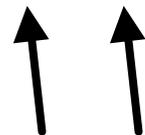
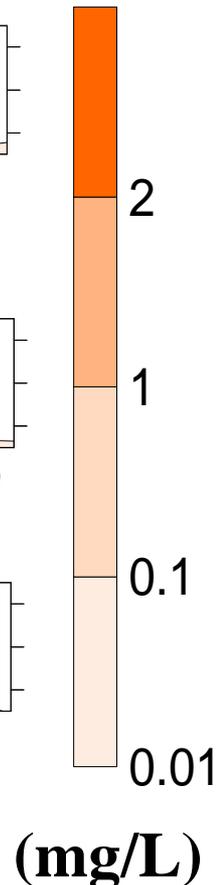
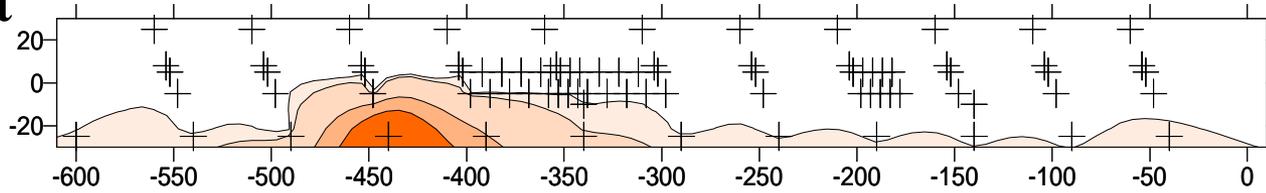
Pre-gas
injection



1 mo.
post
bug
injection



2 yrs. post
bug
injection

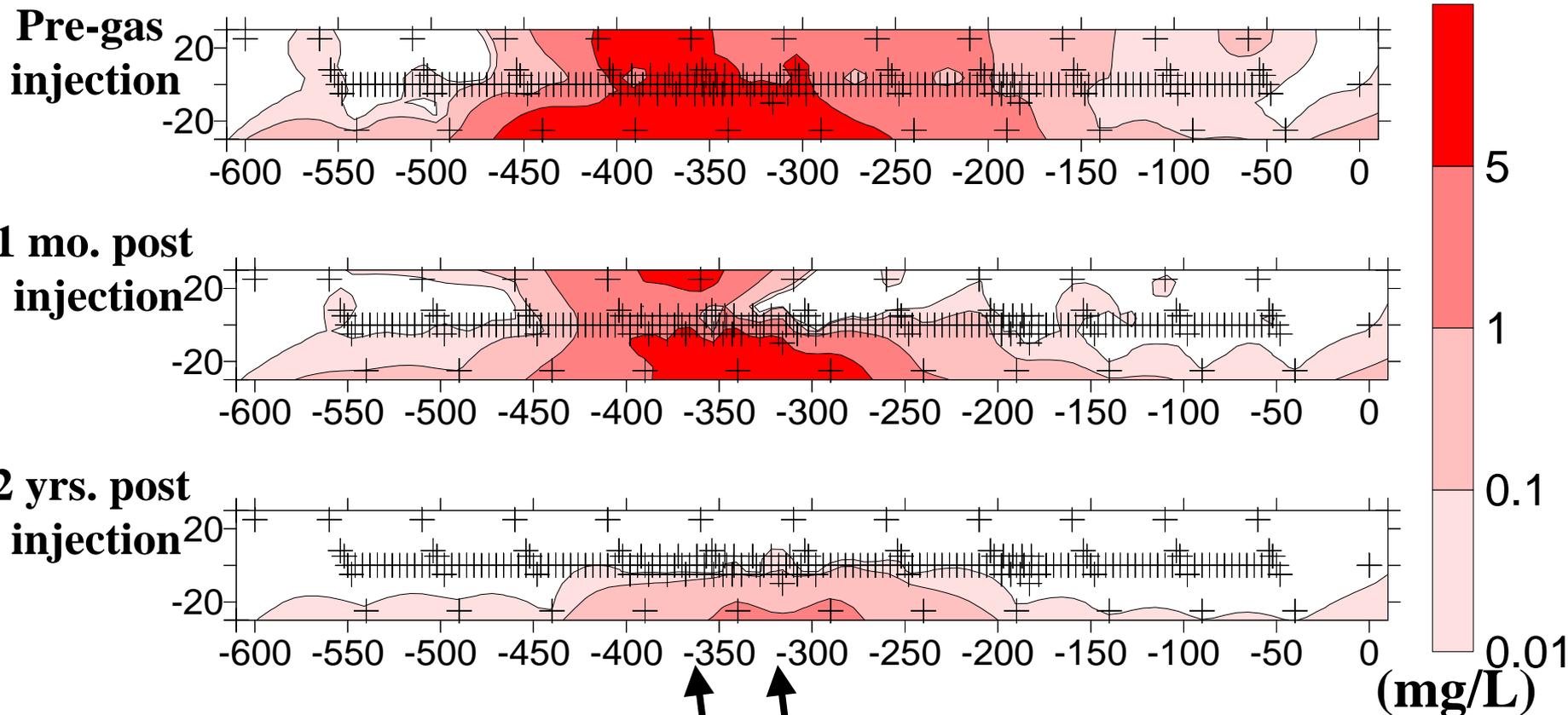


Groundwater flow

(mg/L)



MTBE Distribution



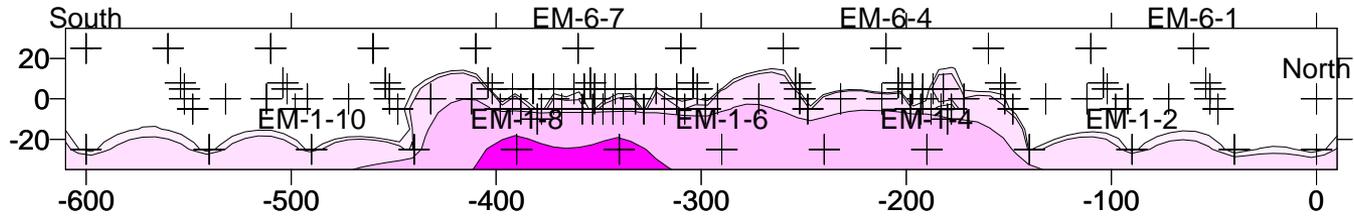
Groundwater flow



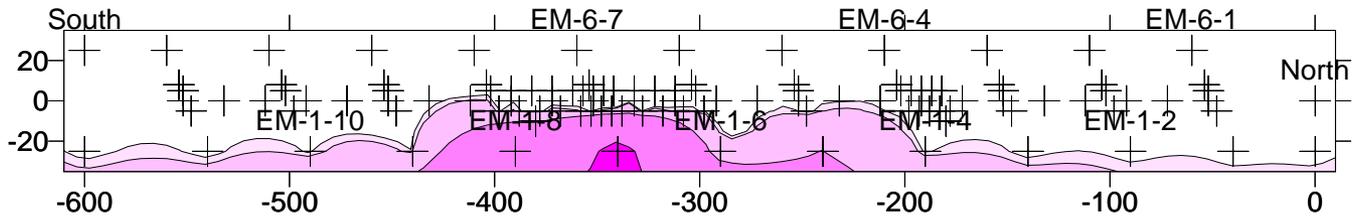
TBA Concentrations



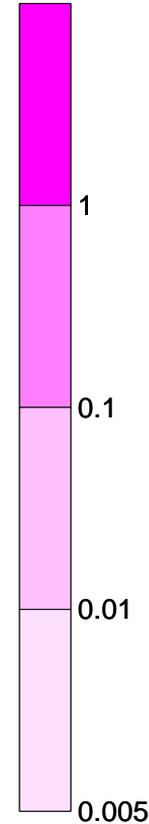
March 2002



October 2002



Groundwater flow



mg/L



Final Remedy Options for NBVC



Operate P&T System / Remove Biobarrier



- **O&M Costs:**
 - FY03 O&M: \$250K/year
 - Life Cycle O&M /Life:
\$54M / 240 years
- **Advantage:**
 - P&T at leading edge of plume
- **Issues:**
 - High O&M/long service life
 - Disposes 1 million gallons to sanitary sewer annually
 - Est. 200 years to capture 200 gallons of MTBE between biobarrier and P&T



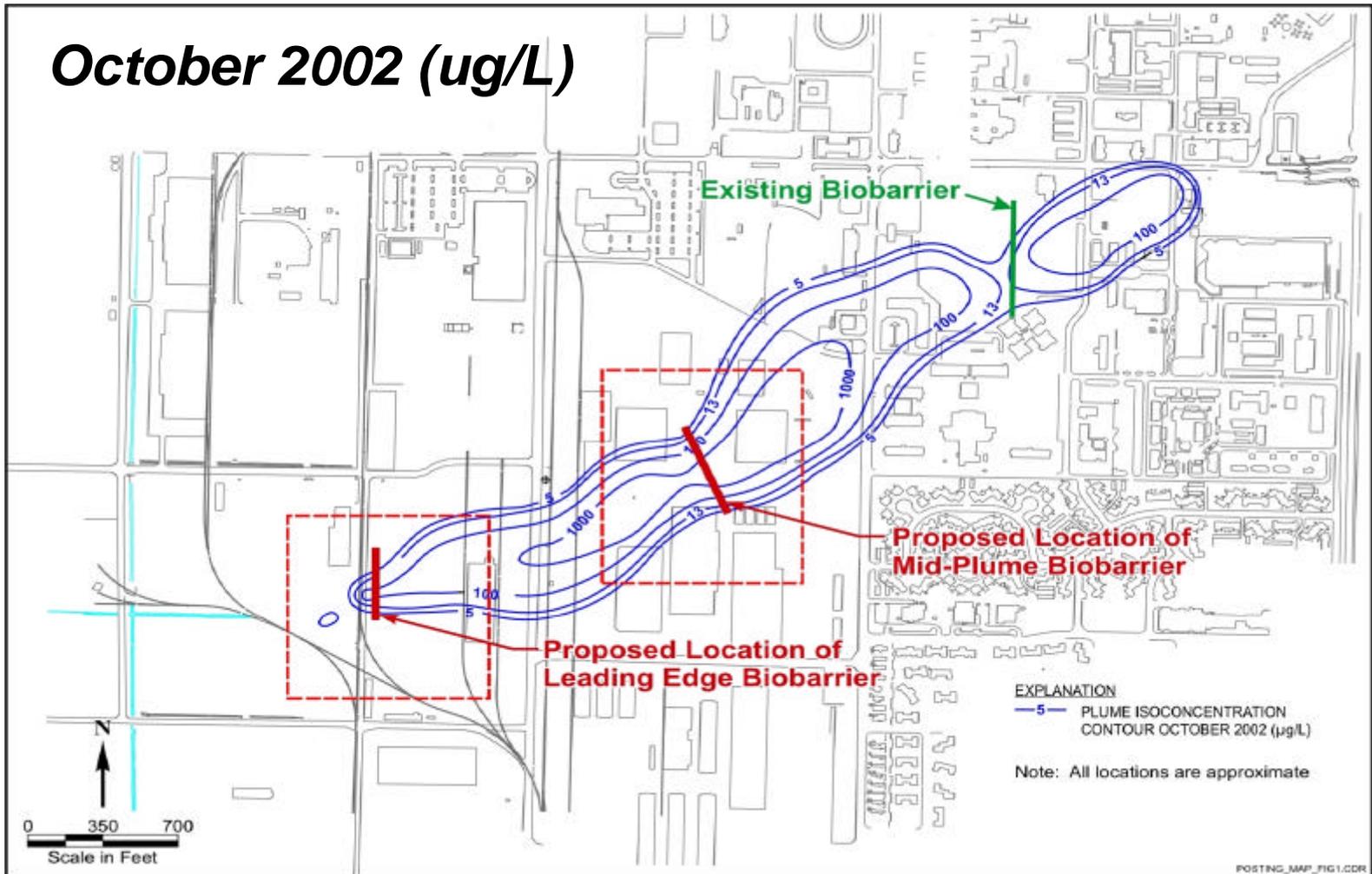
Remove P&T System / Operate Biobarrier



- **O&M Costs:**
 - FY03 O&M: \$50K/year
 - Life Cycle O&M /Service: \$3M / 40 years
- **Advantage:**
 - Low O&M costs
 - Complete mineralization of MTBE to CO₂ and water
- **Issues:**
 - 200 gallons of MTBE down gradient of biobarrier.
 - Model predicted MTBE may discharge into surface waters.



MTBE Isoconcentration Contour Map



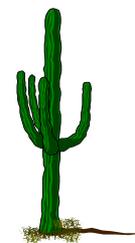
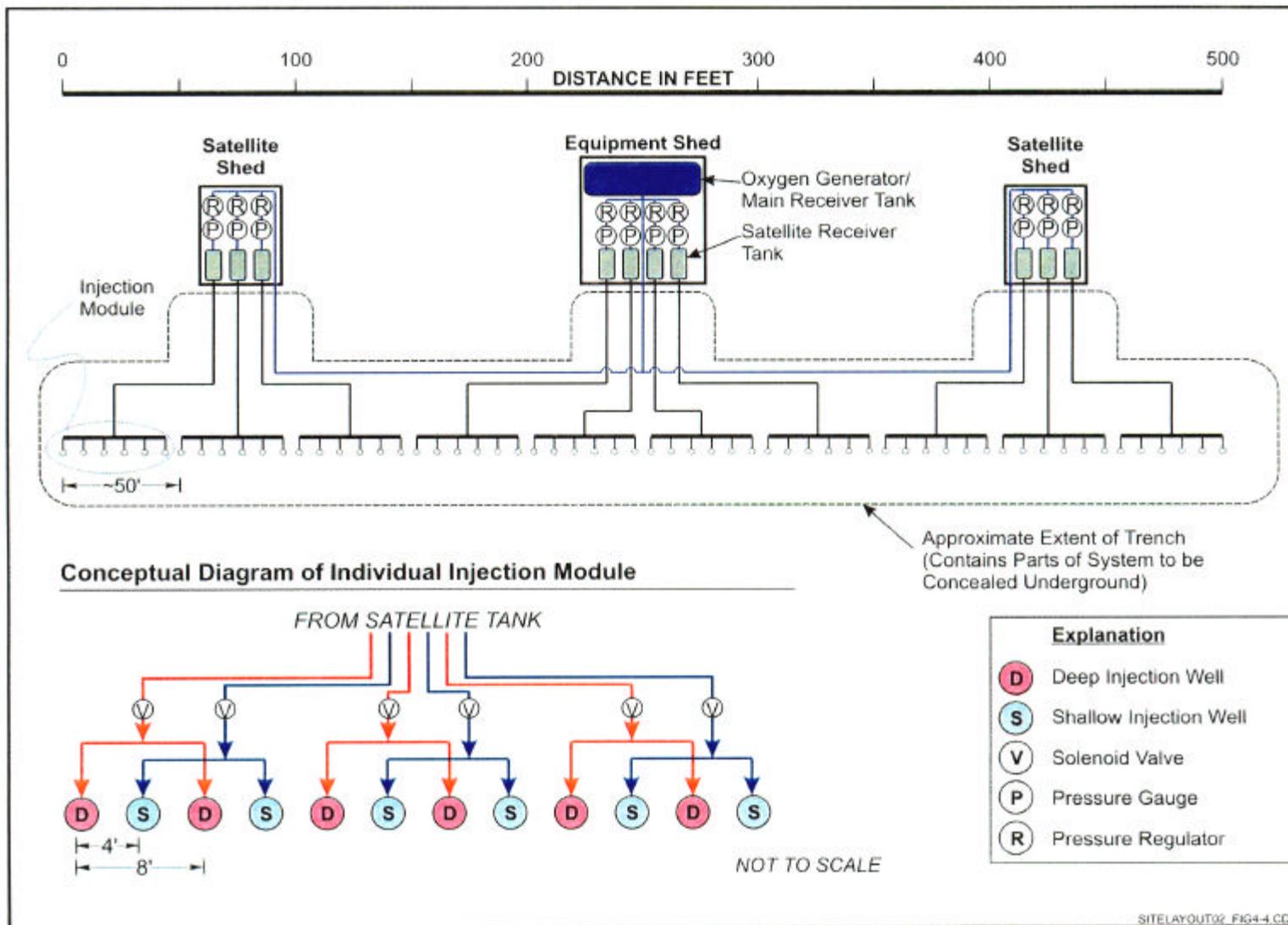
Installation of Two Additional Biobarriers



- **Installation Costs:**
 - \$500K to install two additional biobarriers (a 400 foot wide and a 500 foot biobarrier)
- **O&M Costs:**
 - \$125K/year
- **Advantage:**
 - Completely contains MTBE plume
 - Protects against future spills
 - No groundwater or other disposal costs



MTBE Biobarrier Diagram



Leading Edge Biobarrier



- 400 feet wide biobarrier
- Wells on 8 foot spacing (96 wells)
- Multi-level injection depth

